

Native vegetation and its ecosystem current situation in Brazil

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Abstract: Brazil has a variety of native vegetation. This paper gives introduction about caatinga in the north-eastern dry part, cerrado in central part, patanal in southwest, Amazon rain forest in north and northwest, grassland in south, Atlantic rain forest in eastern coast and mangrove and marsh in coast lines. Where there has the greatest biological diversity in the world, about 10% of all the Earth's species are found. It's the luckiest country in the world for abundant natural resources. Unfortunately, Brazilian ecosystems were and are threatened by massive deforestation, burning and pollution, due to the uncontrolled expansion of agriculture, timber exploitation, land speculation, colonization, and mining.

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Geography and climate

Brazil lies in southern hemisphere, with an area of 8,511,965 km², 90 percent of the country is within the tropical zone. There are five climatic regions in Brazil: equatorial, tropical, semi-arid, highland tropical, and subtropical. There is neither blistering heat nor severe cold. The annual average temperature in the Amazon region is in the range of 22-26°C, almost no seasonal variation, temperatures of above 32°C are rarely happened there. Northeast is the hottest part with temperatures of more than 38°C in dry seasons. Along the Atlantic coast, annual average temperature is from 23 to 27°C. Central and western part of Brazil, where is so-called inland, temperatures are ranging from 18 to 21°C. In southern Brazil like Rio Grande do Sul, the seasons are similar to those in temperate zones in China with variation in seasonal temperatures and the average temperature is 17 to 19°C.

The most intense and heavy rainfall is in the mouth of the Amazon River near the city of Belem, which is open to Atlantic oceans, where there the rainfall is more than 2 000 mm per year. In upper Amazons and along the edge of the great escarpment in Sao Paulo have similar rainfall. Annual rainfalls from 1 000 to 1 500 mm are found in most areas, which focus in summer, from December to next April. Winter is also dry season with little rainfall throughout the country. The most drought weather occurs in the northeast, the so-called "polygon of drought", covers

nearly 10 percent of the country's territory. Rainfall is much lower evaporation rate is fairly higher than any other part. It's almost impossible to plant crops there. Along the coastline, from Recife to Rio de Janeiro, the mountains stop humidity from the wind and make rainfall possible in front of Atlantic Ocean but block it move to the hind areas of the mountain chains such as Salvador, turning this area to a dry part.

Topography of Brazil is dominated by two major features, the Amazon River with its surrounding drainage basin of 4 million km² and the Brazilian Central Highlands, a plateau that begins from the south of Amazon. Altitude of the Highlands is from 300 to 500 m above sea level, most are tablelands. The Highlands ascend steeply in the east, where several peaks reach an altitude of 2 500 m or more, and then descend suddenly to a narrow plain along Atlantic coast. High mountain ranges extend from south to northeast making the country separated between coast and the interior territory.

Weather, geography and soil conditions make Brazil's vegetation vary a lot in many areas. In the Amazon basin and in those places along the Atlantic coast where there have very heavy rainfall, is rich and famous for tropical rain forest mainly composed of broadleaf evergreen trees growing. The rain forest also known Plant Kingdom is made up of a large number of different species, commonly as many as 1 400 plant species could present in one square km. Semi-deciduous forest grow in eastern coast, where there has less rainfall than Amazon and quite dry in winter. The trees are smaller than those in the rain forest and their leaves fall down in the dry season. In northeast, the caatinga, a kind of dry bush with growing on rocky and poor soils is dominated vegetation. The central part of Brazil is covered with a woodland

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savanna, known as the cerrado. In Brazilian Portuguese, this special type of land includes sparse scrub trees and drought-resistant grasses. In south Brazil, conifer forests such as Paraná-pine (*Araucaria angustifolia*) cover the highlands; grassland spreads the low altitude almost sea-level plains. The Mato Grosso swamplands, or Pantanal, a plain which covers 230 000 km² in the western part near of the country and central part of south American continent, is densely covered by tall grasses, weeds, and widely dispersed trees.

Caatinga

Caatinga is from a Brazilian Indian language, which means "white forest". It's a kind of vegetation that is dominated by dry shrubs. In dry season trees lose their leaves with twisted, dry limbs and contorted, crisscrossed branches, stretching flexibly along the ground. The temperature of the ground is possible to reach 60° C. Little rainfall and too much evaporation make caatinga an arid scene in winter. When summer comes and rainfall begins, the ground turns green and shows its vigor. The Caatinga covers backlands of the states of Ceará, Rio Grande do Norte, Paraíba, Pernambuco, Sergipe, Alagoas, and Bahia, southeast Piauí and northern Minas Gerais, around 1.1 million km² with a population of 20 million.

Life of the people living in caatinga is scourged by the weather. Even in raining days it's hard for the rocky soil to store enough water for agriculture except some places close to the mountains where rainfall rates are higher. During the long drought season, caatinga is more like a cloudy semi-desert, with no rainfall. Plants survive the climate by ecological adaptive. They have tiny and numerous leaves, which can keep water and reduce evaporation. Plants like the cactuses store water in the leaves, plants with roots growing close to the surface can take water from ground in raining days.

Since the settlement of human and cattle, effort to store water for the demands are struggled in many areas. Inappropriately used irrigation techniques caused serious problem such as soil salinity, hence agriculture is impossible in those areas. Water pollution caused by chemical kills fish and threaten many other organisms. In the latest 15 years, around 40 000 km² of caatinga have been degraded to desert as a result of humans' disturbance and soil erosion. Large area of vegetation were destroyed and burned for economic project. It's believed that north-eastern backlands of caatinga are one of the most populated semi-arid areas in the world. People are struggling to survive there by exploiting the vegetation and land, species are crying to be protected.

Although its forestry potential is low, caatinga has a medium class soil, not so poor, not so rich. Annual rainfall is from 300 to 800 mm. Trees of 8 to 12 meters high, bushes with height of 2 to 5 m and herbs lower than 2 m compose the landscape of caatinga. It's hard for the plant species to recover after human's serious disturbance. Raining makes caatinga alive and enough food for wildlife.

The major river cross caatinga is São Francisco, with water in dry season, other rivers will either be dry or stop running

Many threatened and endangered species such as spix macaw, sapo-cururu, asa branca, cotia, opossum, cavy, brocket, armadillos, tamarin are living in caatinga.

Cerrado

Cerrado is actually savanna, a kind of dry vegetation featured by grasslands sparsely distributed low trees. It is widely spread in central Brazil covering around 2.1 million km², which is almost the same area of Western Europe, extends in 10 states, from Maranhã, Piauí and Tocantins in north, Bahia, Minas Gerais and São Paulo in east, Goiás and Federal District in the center, Mato Grosso and Mato Grosso do Sul in west. Biological diversity is astonishing here. It's believed that more than 10 000 plant species, at least 420 tree and shrub species, 400 bird species, 67 mammal genera, 30 types of bats and countless insects living in cerrado, where they play a very important role in the ecosystems of Brazil.

Soil in cerrado is very acid with pH value about 4.0, it is really deep and well developed, contains a large amount of metal elements such as iron and aluminum making the soil poor, hard and even poisonous for the plants to develop there. Half cerrado area are distributed of altitude between 300 and 600 m, only 5.5% has high altitude above 900 m, two third of the area are expected to experience 6 months dry winter. Three rivers run across cerrado maintaining the luxuriant and rich biological diversity. 25% of rice and 40% of meat in Brazil are taking from cerrado. It was once recorded 5 harvests in 2 years, 2 harvests a year is common. Although the trees are not good in timber production, a lot of plants are found useful in oil, fibers, cork and medical and food produce.

The cerrado is one of the largest vegetation type, second only to Amazon, also it is the second heavily impacted and destroyed exceeded only by the Atlantic Rainforest. Again settlement is the major factor causing the problem. Mining has ever invoked Brazil's economy and migration, today mining contaminated water bodies and led to soil erosion. Modern technology and agricultural expansion threaten all the life forms and sustainable development in cer-

rado. However cerrado receives little concerns and attention on conservation and protection. Area fragmentation by human's strong impact directly threatens wildlife there. The most threatened and endangered species are *Melanosuchus aiger*, *Rhea americana*, *Agouti paca*, *Tapirus terrestris*, *Felis concolor*, *Sacoramphus papa* and many other species. Only 2% of the cerrado area is protected as either a reserve or a park. Recent investigation show that only about 33% area are reserved. Cerrado is facing the same life as Atlantic rainforest had experienced.

Pantanal

Pantanal is considered the largest and the last ecological sanctuary in the whole World, lies in the center of South American continent and western Brazil. Millions species from fauna coexist with flora in the large natural paradise. Pantanal covers 230,000 km² in Mato Grosso and Mato Grosso do Sul. In Brazilian Portuguese Pantanal means big wetland or swampland. The cycle of life in Pantanal is divided into two distinct periods: flood season in summer and dry season in winter. Rivers such as Paraguay, Cuiabá, São Lourenço, Piquiri, Taquari, Aquidauana, Miranda and Apa are running 4 000 km in Pantanal supporting the habit of plants and wildlife. In rainy season, two third of the area are flooded. Environmental conditions support many types of plants. Some island are high enough to be out of water even in flooding season, there are floating island masses of rivers vegetation, mainly of water lilies, contributed to aquatic plant life, where fish and other animals enjoy their life by laying eggs in the entanglements of the roots, stalks and leaves. Grasses growing along water offer natural pasture for both the grass-eating wildlife and cattle. Palm-tree groves and palm woodlands consist another landscape beside rivers. Color flower trees possess a large area. Moist forest called gallery forests near the riverbanks play a very important role in aquatic life. Some of their plants produce food and organic matters for fish and wildlife and their roots help to retain the sediments matter deposited by the river water during the floods.

Mammals, reptiles, amphibians birds and insects make up such a large part of the swamp ecosystem, 650 bird, 80 mammal, 260 fish, and 50 reptile species are commonly found in Pantanal.

Although much of the region is still unexplored and well protected, Pantanal is facing different threats arising due to economic interest. Impacts increased in the last 20 years with the introduction of exotic forage plants and the exploitation of wooded areas. Artificial disturbance changed Pantanal rapidly, settlement is always the pioneer in this case. Unplanned

settlement of the uplands, where the headwaters originated is the strongest threaten. Farming and ranching are causing massive soil erosion and silting of rivers. Mining, construction of hydroelectric power plants and illegal hunting caused great impact on the wetland. Tourism is a new threaten, in the last few years, Pantanal becomes the third largest touring attracts, exceeded only by Amazon and Foz do Iguaçu. It's annual income changed the life style of local citizens, more hotels and cattle appeared to meet the great demand of tourists. Even the government called to develop ecological tourism, Pantanal is burdened with the biggest pressure that never had before. Project to build waterway transportation will be the most destructive human contribution to the last biggest wetland and refuge for thousands of animal and plant species our planet

Amazon rainforest

It is typical equatorial humid climate in Amazon, which is high temperature with heavy rainfall. Annual rainfall of more than 2 000 mm is common in most Amazon regions. Ecuador Line crosses a city in Amazon, where there has more rainfall than any other part. Amazon rain forest possess around 25% of South America area, distributing in nine countries: Brazil, French Guyana, Suriname, Guyana, Venezuela, Colombia, Ecuador, Peru and Bolivia. 62% of the forest is located in Brazil, with an area of 5 026 552 square km, covers 60% of its territory, spreading the states of Acre, Amazonas, Pará, Rondônia, Roraima, Tocantins, west of Maranhão and north of Mato Grosso. This area is such a big land that it is almost 50% of the European continent. About 18 million Brazilian citizens are living in the last basin in the world. It is estimated that more than one third of all species in the world live and reproduce in the Amazon. Besides 2 500 tree species, which is one third of the world's tropical wood species, the Amazon basin is the largest river basin in the world, covering an area of 6 million square km. The Amazon River, the second longest river, has the biggest water volume, about 20% fresh water stored to discharge into Atlantic Ocean. 30 000 plant species are found in the Amazon forest, which is known as the lungs of the earth, also kingdom of plants is called Legal Amazon in Brazil. Many rare and endangered species such humming birds, macaws, parrots, parakeets, toucans, jacus, hawks, owls, and hundreds of other bird species living in the trees with wildlife terapins, agouties, cavies, tapirs, whose food depends on the trees. Large mammals reptiles also appear there.

Deforestation in the Amazon is serious, over 11 000 km² was cleared in 1991 and this data

reaches 14 800 km² recently. Farm expansion and timber company impacts a lot on Amazon by burning and deforestation. It is estimated that 80% of the timber trade in the Amazon are illegal and 60% to 70% of timber cut is wasted. Brazil has very strict laws to protect the forest. But many difficulties block the enforcement of these laws, such as monitoring and access to the deforest area, economic pressure, hunger and poor of local citizens. Settlement of the Amazon region reached highest speed 1960s encouraged by government wrong policies. Amazon has been suffering a lot during its occupation. Agriculture expansion is characterized by deforestation and burning. About 8% of total forest area has been cleared until 1980s. High inflation led the ranchers to clear more forest area for their cattle to keep as a real capital. Strong sun shine makes the clearing area difficult to recover native vegetation and the consequence is soil erosion and fertility lose. Reservoirs and hydroelectric power plant impacts the environment, social and economic development. Gold mining attracted migrants and now contaminates water body and soil as well as wildlife and human beings.

Atlantic rainforest

The Atlantic rainforest is one of the most endangered tropical forests in the world. It once covered an area of 1 million km², 12% of Brazil's territory, widely spread along the eastern and southeastern coast area, from Rio Grande do Norte, Paraíba, Pernambuco, Alagoas, Sergipe, Bahia, Minas Gerais, Espírito Santo, Rio de Janeiro, São Paulo, Paraná, Santa Catarina to Rio Grande do Sul. Today less than 7% of the original area remains. It still has a large number of fauna and flora species. The biological diversity levels are regarded as the highest on earth in some areas.

The fact is that more than 70% of the Brazilian population live in the Atlantic rainforest region, where there has most of the major and rich cities together with all large industrial factories, oil operations and ports, almost 80% of Brazil's GDP is from this area.

Rivers of Paraná, Uruguay, Paraíba do Sul, Doce, Jequitinhonha, and São Francisco run across the forests. Jequitibá-rosa is a huge tree can be 40 meters high and 4 meters in trunk diameter. Among many other important species, paraná pines and Brazil wood are so famous for their extinction and once supported Brazil's economy cycle. Threatened mammals such as tamarins, otters, jaguars, armadillos, and arara-azul-pequena are native in Atlantic rainforest.

Since the discovery of Brazil 500 years ago, the Atlantic rainforest has been offering timbers, food,

medicine minerals and many other services for the settlers. This is the area that contributed most to Brazil economy cycles and ecosystem was most heavily destroyed. Brazil wood was exploited for its expensive dyes on European market. Paraná pine once extended 100 000 km² was in extinction for its high quality wood in construction and furniture making. Sugar-cane cycle accelerated deforestation to expand agriculture followed by gold mines, which attracted a lot of migrants from Europe and other area in Brazil to settle down in the Atlantic forest. Today unplanned urban development, farming and ranching, paper factory and timber company, petrochemical industrial center emerged and grew rapidly threaten all the species very seriously.

Grassland

Brazilian grassland are separated in two parts: firm soil grasslands, in northern Amazon region, Roraima, Pará, and the Marajá and Bananal islands, where there are low, scattered trees; and prairie in Rio Grande do Sul and Santa Catarina, the southern region, where there are no trees, only some bushes sparsely distributed on a fertile soil amid mild climate. Grassland in south is composed of native grass and leguminosae, spreading more than 200 000 km² with sea level altitude of the region. In this part there exist wetland in coast area which offer habitat for a variety of wildlife such as herons, teals, deer, jaguars, otters, and capivara. Grassland in north is featured by dry areas and forests mainly palms. These forests are regarded to be degraded from clearing of the native forest. Soil erosion and other problems such as desert formation were caused by farming for rice, corn, wheat, and soybean and ranching. In Rio Grande do Sul, forest with huge and ancient trees were burned and cleared for agriculture by settlers from Europe and Asia in the 19th century. More efforts to drain the wetland for agriculture are still threatening this area. When pastures dry up and can no longer support so many animals in dry season, it exhausted its most capacity to meet the demand of ranchers who ignore its sustainable development of the, and soil is exposed to sunshine and wind. Rains easily take off fertilizer and accelerate the erosion process.

Mangroves and marshes

Brazil has about 8 000 km coast line extending along the Atlantic Ocean, with many types of landscapes and ecosystems and different vegetation and biological diversity. More than 50% of Brazilian citizens are living in the coast area, caused serious pollution by agricultural and industrial development.

In north, Amazon coast, which starts from the Oiapoque river mouth to the Parnaíba river, is muddy and more than 100 km wide in some areas. Mangroves and tidal wetland forests are typical and abound. Many reptiles, bird and marine species find the habitat there. The Northeastern coast begins at the Parnaíba river mouth and ends at the Recôncavo Baiano, south of Salvador, where there limestone, sandstone reefs and dunes are common. Mangroves, salt marshes and woody areas also appear. Many threatened species such as marine manatee and turtles are found at seashore. The Southeastern coastal region is from Recôncavo Baiano until São Paulo. This is the most populated and industrialized area. Cliffs, reefs, sandstone formations, and monazite sand beaches are found, Rio de Janeiro is famous for its white and fine sands on the beaches. Salt marsh forests are typical vegetation and ecosystem, where there are many threatened wildlife species such as three-toed sloth and some species of tamarin. In south the coast is between Paraná and Rio Grande do Sul, where there is mainly marshes and mangroves, with a lot of bird species and animals, some of them are endangered such as otters and capivaras.

Ecosystem in the coastal zone is complex providing habitats for the breeding, growth and reproduction of a large number of fauna and flora species. For example, sea shore in Rio Grande do Sul shore is known as a center for migratory birds, almost 570 species have been recorded. Destruction of coastal ecosystem not only threatens marine and wildlife species, but also the human beings living on fishery. Urban expansion, industrial pollution and unreasonable tourism as well as population growth threaten its ecosystem. Degradation of native vegetation by settlers caused many serious problems such as landslide, dune shift and soil erosion. Deforestation of mangroves threatens animal and plant species by losing the best natural "filter" for the impurities to the water body. Roots of mangroves under the water can stop sediment and protect the pollution of coast line, which offers fish harvest. Untreated water materials from cities also have heavy impact on the coastal regions.

Biological diversity

More than 600 mammal species are found in Brazil including several species of the cat family such as the jaguar and smaller cats such as the puma, jaguarundi, and the ocelot. Other mammals include sloths, anteaters, tapirs, armadillos, marine dolphins, capybaras. 55 primate species which is 24% of all in the world, 516 amphibian species, 3010 terrestrial vertebrate species including 310 endangered species, over 100 000 invertebrates were catalogued. 55 000 blossom plant species, which is 12% of all in the world, more than 3 000 fresh water fish species, about 33% of all in the world. Brazil has a larger variety of birds than any other country, with 1 622 species including many varieties of parrot. There are at least 40 species of turtles, 467 reptiles including 120 lizards, 230 snakes, five species of alligators. It is estimated 10 million to 15 million insects in Brazil including catalogued 70 000 insects. The Amazon forest contains the largest single reserve of biological organisms in the world. No one really knows how many species there are in the Amazon forest, but scientists estimate that there are between 800 000 and 5 million species living there, amounting to 15 to 30 percent of all the species in the entire world. Rainforests is very important vegetation on the Earth, which covers only 2% of its surface, but there are around 30 million species of plants and animals, more than 50% of all life forms, live inside the rainforests. Brazil has the largest rainforests, 3.57 million km², about 30% of all, which play an essential role in weather and biological diversity conservation.

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